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Applicants:	Pagotto Amadeo, et al.		Examiner: Joyner, Kevin
Application No:	10/684,314		Art Unit: 1797
Filed:	October 13, 2003		Confirmation No. 3316
Title:	TUNNEL FOR CONDITIONING PRODUCTS. .		

SUPPLEMENTAL DECLARATION OF JEFFREY H. MACKAY UNDER 37 C.F.R. §1.132 IN SUPPORT OF PATENTABILITY

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

I, Jeffrey H. Mackay, declare the following facts knowing them to be true of my own knowledge:

1. I am President and founder of Teo, Inc., assignee of the present patent application.

2. I have worked as a machinist/engineer since the early 1980s.

3. In the past, I have conducted extensive experimentation and design of mechanical and material properties and performance of pressurized food sterilization systems, including the machine automation, microwave application and computer modeling of dependent systems and

subsystems of pressurized food sterilization systems. I have designed pressure systems and worked with industry experts in developing pressurized food sterilization systems including collaborating with a contributing author of the ASME pressure vessel code.

4. I have extensive experience in the fields of food sterilization, food science, microwave systems, in both military and commercial applications, including direct experience as a technician and engineer for General Dynamics working on various air defense missile systems operating with RF, IR and UV spectrums. I have technical experience with high vacuum helium leak detection systems, high pressure 6000-9000 psi argon gas systems including their design, build and repair. Further, I have experience in the development of thermal validation technologies with advanced magnetic sensors.

5. Since April 2005, my responsibilities at TEO, Inc. have included overseeing the development and commercialization of microwave food sterilization systems based on my personal inventions and other patents and rights obtained.

6. Presently, I am a named inventor on two pending United States patent applications in the field of microwave pressurized food sterilization systems.

7. I have filed several previous declarations in support of the above identified application.

8. I would consider myself as one skilled in the art of pressurized food sterilization systems, particularly those employing microwave subsystems.

The Present Invention

9. The present application is directed to a product tunnel having a quadrilateral cross-section with microwave sources directly connected to the opposing sidewalls. As I explained in my previous declarations, the direct connection of the microwave sources to the sidewalls is not mere ornamentation which has no mechanical function. Instead, the direct connection of the microwave sources to the opposing sidewalls is extremely important because this reduces hardware within the microwave chamber which impacts the patterns and interactions of the microwave energy. In addition, the quadrilateral shape of the microwave exposure area with the direct connection of the microwave sources to the opposing sidewalls enables us to more accurately predict and adjust the interaction of the sources (including reflected microwave energy as described in the present patent application) to achieve the heating patterns we desire. By calculating wavelength, distance and media traveled through; the interaction of the microwave sources is tuned to create consistent predictable heating patterns.

10. Furthermore, the present invention includes microwave sources positioned at right angles (90°) to the advance of products. This construction is also extremely important. The microwave sources positioned at right angles (90°) to the advance of products *disadvantageously* increases microwave coupling and corresponding hot and cold spots within the chamber. However *advantageously*, the positioning of the microwave sources at right angles (90°) to the

advance of products within a quadrilateral tunnel enables us to mathematically model standing wave patterns predictive of the interaction from the microwave sources and their interaction with the shape of the exposure cavity. Conversely, it is not possible to create a consistent predictable heating pattern, or at least it is beyond traditional modeling capability, for a microwave exposure area wherein the microwave sources are positioned at oblique angles to the advance of products in a non-quadrilateral exposure area. Merely introducing microwave sources from oblique angles, non-opposed, indirect sources, into non-quadrilateral, curved or irregularly shaped exposure areas would produce variable and unpredictable results in our system. Also of importance, the microwave heating chamber is gaseous tight and pressurized to provide positive pressure to prevent sealed packages from bursting upon application of heat.

11. Notably, no one had previously considered utilizing a quadrilateral pressurizeable heating chamber capable of the higher pressures necessary for preventing sealed packages from bursting upon application of heat. To the contrary, it is well known that preferred pressure vessels include cylindrical or spherical sidewalls to reduce areas of stress which would be prone to failure upon introduction of pressure. Thus, a person developing a heating chamber capable of the higher pressures necessary for preventing sealed packages from bursting would not consider implementation of a quadrilateral structure.

Harris and Wefers

12. I have reviewed the present patent application serial no. 10/684,314. I have also reviewed U.S. Patent Publication No. 20030209543 naming *Harris* as the inventor and U.S.

Patent No. 20020017033 naming *Wefers* as the inventor. Furthermore, I have reviewed the Patent Examiner's most recent *Office Action* dated September 17, 2010 issued in connection with patent application serial no. 10/684,314.

13. *Harris* illustrates a system for heating food employing circular mode magnetic microwave energy. The *Harris* invention embodies a tuned rectangular waveguide (Fig. 3 and 4) circular output section, circular section field formation tube which is attached to an undefined heating chamber (Fig. 5 - 50, 52). All intent on generating and maintaining through monitoring and adjustment within the waveguide a circular mode wave form prior to the introduction into the heating chamber. *Harris* follows all other prior art by introducing microwave energy into the exposure area which is a mere envelope to house the described apparatus.

14. *Harris* illustrates a food conditional tunnel employing microwave processing. Fig. 1 illustrates a "Prior Art" tunnel which appears to be helically formed from single piece of sheet metal in similar manner as a paperclip to form multiple cavities. Clearly, the "Prior Art" tunnel of Fig. 1 is not pressurizeable as it possesses an entrance and exit which are open and not closeable. Meanwhile, the *Harris* provides no description as to the shape of the tunnel other than it is "generally rectangular". (See para. 35). Importantly, the tunnel sidewalls are made of a material "transparent to microwave energy, such as high density polyethylene", and are hollow to function as water tanks 94. (See paras. 36, 47 & 48).

15. Notably, *Harris* does not appear to suggest that the structure provides any particular benefits to the conditioning process. For example, though *Harris* does indicate that the tunnel may include reflectors 102 mounted below the food product, the reflectors are "mounted . . . on the inside surface of the bottom surface of the heating chamber." (Para. 41). Furthermore, the reflecting surfaces may be "curved to focus or diffuse microwave energy, or which are adjustable in position and shape." (Para. 37). Thus, there is no suggestion in *Harris* that the author considered the tunnel shape as affecting the microwave field or that a quadrilateral structure was beneficial to create a consistent predictable heating pattern, or at least one capable of being modeled. Clearly *Harris* saw no beneficial relationship in the shape of the cavity/chamber.

16. Meanwhile, *Wefers* (US Patent Publication No. 2002/0017033) illustrates a microwave tunnel with multiple pressurizeable chambers for drying food products. The conveyor transports include dishes or nets on which products are applied. (Abstract). There is no suggestion that products incorporate packaging, and certainly not a suggestion that the *Wefers* construction provides sufficient pressure to prevent packages from bursting. To the contrary, though *Wefers* does, in passing, suggest that tea may be dried in a positive pressure (para. 18), Wefers is primarily directed to removing moisture utilizing a vacuum-negative pressure. (paras. 3, 4, 9, 18, 19, 40, 43, 48, 55, and 60, and claims 1, 7, and 15). Furthermore, *Wefers* provides no explicit description of the cross-section of such chambers, nor does it relate to the exposure area in any way to microwave application. However, if one were to be implied, it would be cylindrical, as cylindrical structures are preferred for pressurized (either negative or positive)

applications due to the shape's capability of withstanding the stress and strain imparted by uniform pressure. For example, *Ruozi*, described below, indicates that cylindrical structures are preferred for pressurized microwave applications.

17. Thus, as in previously cited prior art, both *Harris* and *Wefers* are merely describing enclosures (envelopes) to house their various apparatus. They did not understand that the tunnel construction and positioning of microwave sources has a dramatic impact on the creation of hot spots and cold spots during the heating process. And, for those skilled in the art, the only shape considered desirable for pressurized microwave applications was cylindrical.

18. I further note that neither *Harris* and *Wefers* suggest a pressurized tunnel pressurized to provide positive pressure to prevent sealed packages from bursting upon application of heat.

19. *Harris* illustrates a food conditional tunnel having an open entrance and exit which is clearly not pressurizeable. Furthermore, no one ordinarily skilled in the art would apply the structure of *Harris* to a pressurized system. The *Harris* tunnel is described as made of the plastic polyethelene which is **not** a material one would use for pressure applications. Further, the tunnel sidewall is surrounded by water within a water tank (para. 36, 47 and 48 and Fig 6). Simply, no engineer would look at *Harris,* with its plastic hollow water-filled sidewalls, and think that they want to pressurize such a structure.

20. The *Wefers* tunnel is described as pressure-tight. However, the only explicit teaching of a pressure for the tunnel is that the tunnel operates at a *reduced pressure of about 10-100mbar*. (Para. 18). *Wefers* does state that the tunnel may be used for pressure "above atmospheric" to dry products such as tea. However, "above atmospheric" is vague at best, and clearly, there is no suggestion that the tunnel provide sufficient pressure to prevent packaging from bursting during a sterilization process.

21. Thus, after reading both Harris and Wefers, one would not think to develop the present invention of a pressurizeable microwave heating tunnel having a quadrilateral structure and pressure source for providing sufficient pressure to prevent the bursting of packages.

Previously Cited Prior Art Muller, Akutsu, Lipoma, and Ruozi,

22. Only *Muller* (U.S. Patent No. 3,402,277) clearly understood that the tunnel construction and positioning of microwave sources has a dramatic impact on the creation of hot spots and cold spots during the heating process. Prior to *Muller,* no one had previously related the shape of the exposure structure to the relative positioning of microwave sources. *Muller* was actually extremely insightful and understood that the shape and positioning of microwave sources was important to product heating. However, *Muller* employed an octagonal microwave tunnel constructed to achieve exactly the opposite microwave environment than the quadrilateral tunnel of the present invention. To overcome the problems of hot and cold spots within the exposure area *Muller* creates a series of oblique angled introductions of microwave energy and angled reflecting surfaces.

23. Meanwhile, the apparatus of the present invention is the exact opposite of *Muller* in both configuration of the apparatus and functional intent. Whereas, *Muller's* construction is intended to randomize microwave energy and reduce coupling to reduce hot and cold spots, the construction of the present invention, with a quadrilateral tunnel and microwave source that are positioned at *right* angles relative to the travel of products, actually encourages microwave field coupling allowing for the creation of predictable stable hot and cold patterns. These patterns can be predicted allowing for tuning to achieve a stable pattern with minimal thermal deviation. The ability to maintain a stable pattern of heating in an exposure allows for layering of additional exposures with complementary patterns to produce uniform heating.

24. *Akutsu* (U.S. Patent No. 4,809,596) does not disclose a cross-sectional configuration, and if one were to be implied it would be cylindrical based on Figure 1. *Akutsu* make no relation between the shape of the area where heat energy is applied and the source of the heat energy. The structure is merely an enclosure which houses an apparatus that utilizes a radiated heat source and a deflector (see 200). Furthermore, *Akutsu* illustrates a product drier. The construction would never be positively pressurized in the wildest stretch of the imagination nor would anyone relate structures from a drying apparatus to a pasteurizer-sterilizer.

25. *Lipoma* (U.S. Patent No. 3,718,082) does not disclose a preferred cross-sectional configuration, nor does it disclose placement of microwave sources, nor does is disclose the structure or how they are attached or relate to the exposure area in any way. *Lipoma* indicates

power sources can be located inside the chamber or provided through suitable waveguide. *Lipoma* discloses that the "Pressurized Tank" may be any shape. Specifically, *Lipoma* states that the tank "may be rectangular or circular or elliptical or **any** other desired shape". (Emphasis added). This statement clearly indicates that *Lipoma* saw no beneficial relationship between the manner in which the microwave energy is introduced into tunnel and/or the shape of the cavity/chamber. This conclusion is explicitly reinforced where *Lipoma* specifically disclaims at column 5, line 40, "the invention does not rely on any particular microwave oven".

26. Furthermore, with reference to the figures, *Lipoma* suggests a tunnel having only a single microwave source which passes through one sidewall of the conditioning tunnel. Thus, *Lipoma* does not suggest directly connecting first and second sets of microwave sources to opposing sidewalls for causing microwave energy to emanate from opposite sides of products passing through the tunnel, as claimed by Applicant.

27. *Ruozi* (U.S. Patent No. 5,074,200) clearly defines the shape of the pressure vessel and does so as cylindrical. As is well understood by those skilled in the art, the cylindrical shape is employed because cylindrical and spherical shapes are the most desireable for pressure vessels as such shapes eliminate angled seams (such as found in a quadrilateral construction) that would be susceptible to failure due to increased stresses. *Ruozi* also identifies the positioning of the microwave sources in relation to the conveyed food. *Ruozi* does not affix the sources to the structure; instead microwave energy passes through a waveguide to adjacent the heated products.

Conclusion

28. The present invention requires the combination of a unique pressurizeable structure of a quadrilateral design with the microwave sources affixed to opposing sidewalls and attached directly to that tuned structure. The pressurizeable structure allows one to adjust the phase of the incoming waveform to shift heating patterns within the geometry of the target product and control the interaction of the waveforms. Furthermore, the claimed structure allows one to adjust the phase of the incoming waveform to shift heating patterns within the geometry of the target product.

29. Spanning back to 1966 (*Muller*), only *Muller* had conceived of the structural relationship between cavity shape and product heating. However, he approached the problem in an entirely different manner employing an entirely different cavity structure (octagonal) than the present invention. The remaining prior art, and specifically *Akutsu, Lipoma, Ruozi, Harris* and *Wefers* all merely created an envelope (cavity) to contain their invention. *Akutsu, Lipoma, Ruozi, Harris* and *Wefers* all utilize the pressure vessel as a "tank" enveloping the described mechanical apparatus. They do not define or imply in any way a desired embodiment for the shape and configuration of a structure for the application of microwave energy. Thus, if a skilled artisan were to review all of these references for pressurized conditioning of food products, one would select either an octagonal cross-section in accordance with *Muller* to randomize microwave energy to reduce hot and cold spots. In the alternative to octagonal, one would select a circular cross-section in accordance with *Ruozi* to address the increased pressure required for the prevention of bursting packages.

30. However, there is no suggestion in any of these references, even if read together, to create applicant's invention of a pressurizeable microwave heating tunnel having a quadrilateral structure with the microwave sources affixed to directly opposing sidewalls and a pressure source for providing sufficient pressure to prevent the bursting of packages.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the U.S. Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Executed this 16th day of March 2011 at SAN DIEGO, California.

By:
Jeffrey H. Mackay
CEO
Teo, Inc.

By:
Jeffrey H. MACKAY